Maggot and Worm Revisited: The Role of the Entomologist in Homicide Investigation

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ABSTRACT

A postmortem interval of 19-20 days was estimated for the remains of a female, ca. 48 years of age, recovered from a ditch on the island of Oahu, Hawaiian Islands, based on an analysis of arthropods present on the remains.

Exposed remains present a temporary and progressively changing habitat and food source for a wide variety of organisms ranging from bacteria and fungi to vertebrate scavengers. The arthropods comprise a major element of this biota and previous studies have shown that the various taxa arrive at the remains in definite predictable succession patterns (Early & Goff in press, Payne 1965, Reed 1958). Beginning with the work of Megnin (1894), knowledge of these sarcosaprophagous arthropods and their succession patterns have been used by forensic science in the estimation of postmortem intervals in cases of homicide, suicide, accident or unattended death due to natural causes. As a preliminary part of a program in forensic entomology in the Hawaiian Islands, decomposition studies were conducted at various localities on the island of Oahu to establish baseline data. These studies were a cooperative effort of the Department of Entomology, University of Hawaii at Manoa, and the Department of the Medical Examiner, City and County of Honolulu. Partial results of these studies and techniques have been previously reported by Early & Goff (in press) and Goff et al. (1986) as a checklist of arthropods associated with exposed carrion, including human remains.

While there are a number of publications available detailing the results of decomposition studies conducted with various animal models, there are relatively few demonstrating application of results of these studies. During the period from Feb. 1983 to May 1986, 27 cases were referred to the Forensic Entomology Laboratory, University of Hawaii at Manoa, by the Chief Medical Examiner, City and County of Honolulu, for determination of postmortem interval by entomological techniques. One of these is presented below as a case study.

CASE STUDY

The remains of a 48 year old female, who had been reported missing, were discovered in a brush-filled drainage ditch in a predominantly industrial area outside of Honolulu. The remains

were in a moderately advanced stage of decomposition and definitive identification was accomplished by dental comparison techniques. The body was lying on its back across the ditch, which was partially filled with water. The skull was largely devoid of flesh and the mandible was separated from the skull but adjacent to it. Three toes of the left foot were missing. The left hand was missing below the wrist, but the right hand remained intact, although mummified. The remains were clothed in a blackened skirt. Upper, exposed portions of the remains were dry and partially mummified, while the lower, partially immersed portions presented the appearance of the advanced decay stage as characterized by Early & Goff (in press). Both feet were in a dehydrated condition, as was the case for the right hand and arm. The rib cage was exposed with some shreds of dried skin attached.

Further examination of the remains at the morgue revealed the body to be largely skeletonized with no internal viscera remaining and only portions of parchmentlike skin covering the neck, face and lower extremities. With the exception of a fractured hyoid bone, no evidence of intravitous traumatic injury was observed. The damage to the left hand and foot was interpreted as postmortem vertebrate animal depredation. Based on the presence of the fractured hyoid bone, cause of death was listed as manual strangulation.

Collection of insects associated with the remains were made during autopsy procedures. Portions of the body which had been immersed in water yielded larvae of Calliphoridae and Sarcophagidae. The calliphorid larvae were identified as Chrysomya megacephala (Fabricius) and later confirmed by rearing of representitive larvae to the adult stage in the laboratory. The sarcophagid larvae were not successfully reared and the species identity remains uncertain. The larvae collected closely resemble those of both Bercaea haemorrhoidalis (Fallen) and Boettcherisca peregrina (Robineau-Desvoidy), both of which are commonly associated with exposed remains in the Hawaiian Islands (Goff et al. 1986). A greater variety of insects was present on the drier portions of the remains. Larvae of the piophilid Piophila casei (Linnaeus) were collected along with emergent 3rd instar larvae of another calliphorid, Phaenicia cuprina (Wiedemann). Empty pupal cases of a 3rd calliphorid, Chrysomya rufifacies (Macquart), were present, attached to exposed ribs and leg bones. Adult dermestid beetles, Dermestes maculatus DeGeer, were present on the external surfaces of the remains and examination of the body cavities during autopsy revealed a large number of both early and late instar larvae of this species. Clerid beetles, Necrobia rufipes (DeGeer), were also present on the external dried surfaces of the remains.

On the following day, additional collections of arthropods were made at the site of discovery of the remains. These were made by hand and using a Berlese-Tullgren funnel process. These

collections yielded additional specimens of C. megacephala larvae, P. cuprina larvae, and adults of both D. maculatus and N. rufipes. During this site visit, larvae of C. megacephala were observed in the water in the ditch near the former location of the remains.

Computer comparisons with data from 2 decomposition studies at sites having similar habitats to that of the case in question generated a postmortem interval estimate of 19-20 days. This estimate was based on species somposition of the insect assemblage present on the remains and developmental stages represented.

Remarks. The estimated postmortem interval fits well with the last confirmed sighting of the individual on the night 20 days prior to the recovery of the remains. Insects of primary significance in the postmortem interval estimate were C. rufifacies and D. maculatus, as these were the species showing the longest period of residence on the remains, as indicated by developmental stages collected. Developmental times for C. rufifacies under ambient temperatures on the island of Oahu were determined to be 10-12 days during earlier baseline studies. This species is among the first to arrive and oviposition continues for the first 4-5 days of decomposition. Presence of only empty, weathered pupal cases of this species indicates a minimum postmortem interval of 16-17 days. Dermestid beetles associated with remains in habitats similar to that of the present case appear first between days 6 and 8. Late instar larvae of D. maculatus found in the body cavities were consistant with a 19-20 day postmortem interval. Also consistant with that interval were the pupae of P. cuprina in the soil near the remains and the emergent 3rd instar larvae of that species and adults of the clerid N. rufipes on the drier, exposed portions of the remains. While the general trend in decomposition studies was for the piophilid P. casei to first appear during the dry stage of decomposition, this was not consistantly the case and thus its significance was not major in the postmortem interval estimate.

Initially the presence of larvae of C. megacephala and the sarcophagid species distorted the picture. Larvae of these taxa had not been observed after the decay stage in studies conducted in lowland areas. A similar situation existed for P. cuprina, although that species had occasionally been recovered as larvae during the early part of the dry stage. Subsequently, in studies conducted in rain forest areas, larvae of these taxa were recovered in stages of decomposition comperable to those in the present case. The major limiting factor for exploitation of remains by these taxa appeared to be moisture and partial immersion of the remains in water served to keep them in a condition suitable for oviposition by adult flies longer than would have normally been the case in dry lowland areas.

At a subsequent trial in Honolulu during Sept. 1983, the male in whose company the victim was last seen was found guilty of the charge of murder.

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